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Executive Summary

As part of WP4.2, the LBI did a market analysis of cultural trends and customer behaviour regarding protein consumption. The market analysis gives input for the optimal development of new protein-based concepts that best meet the needs of today's consumers, and give an insight into the potential market opportunities in the short and medium terms of the innovative protein food products. This involved identifying consumers' preferences, needs and aspirations regarding plant protein. A consumer panel was given the chance to test 11 categories of novel plant protein products in their own kitchen followed by a focus group discussion that focussed on their motivations, preference in packages, why they choose animal or vegetable proteins, what attracts them, and what are these choices based upon.

Target group of this study: the Meat reducers

The target group for this study are the meat reducers. This group is most open to new plant protein products, other names for them are part-time vegetarians or flexitarians. The criteria to be a meat reducer is having at least one meatless day per week. 67% of the Dutch population says to have one or more meatless days a week. The meat reducers do not deem meat to be essential but rather enjoys the flexibility to eat meat if it fits the social setting or their mood. The reducer group is very heterogeneous in their ways of consuming less meat and their reasons for doing so. To better understand this diverse nature two consumer profiles were added: the social comfort shopper and the conscious quality consumer.

The goal in this study is to explore the food landscape to find opportunities for novel plant protein products. Based on the literature, the key barriers and drivers concerning the acceptance of meat substitutes and novel plant protein products have been identified. The key barriers were unfamiliarity with the product, fear of new food types (resulting in a high score in Neo Food phobia), sensory: textures, taste, smell, look, food identity (Meat lovers think meat is essential to one's health). The key drivers were: openness to new foods (Low score in Neo Food phobia), reduction of the environmental footprint, animal well-being, health.

The meat reducers make up 50-70% of the population in most EU countries and are open to reducing and replacing meat with other options. To get insights relevant for new product development we reduced the barriers as much as possible by selecting consumers with a low score in Neo Food phobia and by providing recipes to accompany the products and instructions on how to prepare them. Within the meat reducer group, a further selection is made based on traits that correlate with being an "Early Adopter" and "Early majority" for novel protein foods according to the "diffusion of innovation model" of Rogers. The "Early Adopters" and the "Early Majority" traits for favouring plant protein have been categorized as 18-35 of age and living in an urban environment.



In total, 31 people applied for the study, and 30 were accepted based on the criteria. Two of the accepted people dropped out later. Of the 28 participants were 64% female. The average age was 27 with (SD 5) and the Neo Food Phobia score was 23 (SD 6). 25% were considered Neo Food Phillic (attracted to trying new food concepts) with a score below 20. The participants were asked what their motivation was for not eating meat at least once a week, and the answers are summarized in table 1

Table I What was your motivation for not eating meat at least once a week?

Reasons given n=28	%
Environmental concerns	78%
Animal well-being	41%
I don't need it	30%
Health	22%
Financial	11%
Variation	7%

Research strategy for product testing in a home setting

Plant proteins can be applied in several different product categories. In order the test how consumers would respond to a certain type of plant protein products, these were tested matching the 14 characteristics of products and categories (below) created in collaboration with the WP3 partners eleven products were tested in a home setting and 3 more categories (protein enriched breakfast cereals, protein enriched milk and protein enriched sweet snacks) were added in the questionnaires for the association's test. Categories and products tested were:

1. Very similar to meat, (vegetarian chicken from the vegetarian butcher)
2. Not similar to meat (Quinoa burger from Nature Crops)
3. Traditional meat replacement like tofu (Lupin tempeh from Bumi)
4. Savoury snacks (roasted Fava beans from the Albert Heijn)
5. Sweet snacks like biscuits (only fictive product was tested)
6. Protein enriched pasta (from Tasty Basics)
7. Protein enriched bread (from Tasty Basics)
8. Protein enriched plant milk (only fictive product was tested)
9. Protein enriched breakfast cereals (only fictive product tested)
10. Beans/Seeds emulating a specific dish like couscous and risotto (Quinotto from Nature Crops)
11. Easy meal solution, Beans “made easy” cooked with sauce (Chickpea curry from Boon)
12. Lupine beans in glass (Ekoplaza home brand)
13. Lupine beans dried and chopped (Lupin.eu)
14. Pulse-based spread (Lupi love spread from zwergenwiese)



Meat replacers: It became clear that within the meat replacer group the “high-quality imitation to meat” and the “not similar to meat” categories were viewed very differently. The high-quality imitation struggles with the bias of having to be very similar or even better than the product it tries to imitate while being preferably cheaper. The “not similar to meat” plant protein products did not suffer from this association and were considered to be more sustainable than the “high-quality imitation” Products in the study.

Snacks: Sweet snacks like biscuits often contain sugar. A substance the consumers indicated they wanted to avoid. They were also considered to be a lot less sustainable than savoury snacks. The savoury option was viewed more positively in the light of protein associations and it was indicated by the group that they would like to see more of those developed with the following characteristics: Low on sugar and salt, filling, easy to take on the road.

Staple foods: The tested staple foods (bread, pasta, milk and breakfast cereal) are part of the common diet in most European countries. It is already common that these products come in a great number of varieties, and a protein-enriched version is simply another addition to that, which makes accepting the new introduced products easy. Because increasing protein consumption itself is not a goal of the meat reducers the selling point should be sought elsewhere, like health benefits, environmental benefits, increased satiation or improved flavour. The negative associations to be avoided are “being more expensive than the original” and “Being overly processed and therefore less sustainable”

New sources of plant protein: lupine bean

Most European consumers are not familiar with the sweet lupine bean that can be consumed in a similar fashion to white beans or chickpeas. In order to test their reactions to different forms of Lupin beans the subcategories of Lupine beans in glass, Lupi Love curry spread and the subcategory dried chopped Lupin beans with a similar function to rice or oats were tested. The Lupin bean’s firm bite was considered novel and yielded mixed reactions from the consumers. Because it was a new product they also struggled to pair it with other flavours. The Lupine spread was very positively received and scored second tastiest in Table II. The recommendation for lupine is to deliver it processed and spiced into a recognisable product.



Table II Products tested in home setting (scored on a scale of 1-7)

	Products n=28	Tasty	Familiar	Easy to prepare	Recommend
1.	Quinoa burgers	6,0	2,8	6,5	5,9
2.	Lupi love spread curry flavour	5,9	1,9	6,8	5,7
3.	Fava bean snack soy sauce flavour	5,8	2,0	6,5	5,3
4.	Quinotto	5,8	3,2	6,0	5,4
5.	Vegetarian chicken	5,6	4,8	6,5	5,8
6.	Protein enriched bread	5,6	1,9	6,8	5,5
7.	Chickpea curry in a bag (readymade)	5,4	2,1	6,8	4,9
8.	Lupin beans in glass	4,9	1,5	6,5	5,1
9.	Lupin Tempeh	4,5	2,6	6,1	4,6
10.	Protein enriched pasta	4,3	2,0	5,9	3,9
11.	Lupin beans dried and chopped	3,4	1,3	3,9	3,2

Focus group discussion panel

28 consumer panel members who also participated in the product testing joined a focus group discussion in an average setting of 9 people. Within their motivation and choices, two subgroups became apparent. The "social comfort shopper" who is interested in status, feeling healthy and discovering new things, and the "Conscious quality shopper" who wants to do the right thing, is socially involved and focused on self-growth and exploration. The following conclusions could be made from the focus groups:

- The fake meat dilemma. A part of the consumer panel members stated that they strongly dislike the concept of highly similar meat replacements because it feels like "tricking yourself with fake meat."
- "We don't care about increasing protein, we care about avoiding sugar."
- Clean label is important. A label should not contain E-numbers, chemical names and out of place sounding ingredients.
- Soy is a necessary evil and more local environmentally friendly options would be welcome.
- Consumer panel members trust in the Skal Organic logo alone.
- The food information is so diverse, that consumer panel members don't know how to truly do the right thing.
- Conscious quality shoppers trust organic stores and look at the ingredient lists.
- Social comfort shoppers trust the front of the package.
- Take care with claims as conscious quality shopper could respond negatively to "replace with, added to and removed" claims.
- New food technologies are welcome if they are sustainable and healthy.
- In the future, the consumer panel members would like to see an oatmeal-like quick savoury breakfast option, healthy sweet & savoury snacks that are low in sugar and salt and a vegan version of the egg developed.



1 Introduction and objectives

The LBI did a market analysis of cultural trends and customer behaviour regarding protein consumption. The market analysis will provide key input for the optimal development of new protein-based concepts that best meet the needs of consumers. This is to give an insight into the potential market opportunities in the short and medium terms of the innovative protein food products evaluated in terms of market share. The analyses included an understanding of consumer acceptance and behaviour, and the assessment of the social, economic, policy and environmental implications of the related products in the study.

This involved identifying consumers' preferences, needs, aspirations and cultural values. A Dutch consumer panel was given the chance to test 11 categories of novel protein product in their own kitchen followed by a focus group discussion. The discussions were directed on the motivations and preferences of why people eat protein rich food, why they choose animal or vegetable proteins, what attracts them, and what are these choices based upon.

1.1 Background literature

Based on WP4.1 findings it showed that 17 out of 26 EU countries part of the research decreased their animal protein consumption between 1993-1997 and 2008-2012. From these 17 countries, the plant protein consumption was increased in 9 countries, whereas the total protein consumption was decreased in 8 countries. This is in line with the findings of Dagevos *et al.* who state that meat as the main protein source is still very popular in Western European diets, yet its popularity has steadily started its decline. According to the reports of Bakker and Dagevos (1) (2) three clear profiles can be determined by meat consumption pattern:

The meat lovers. The lovers associate eating meat with enjoying life, masculinity and status. The lovers will be very reluctant reduce their meat intake and show an aversion to meat substitutes. They are often more conservative and traditional in their food choice and are more often prone to having neo food phobia. The lovers make up around 25-30% of the consumer population in the Netherlands and the United Kingdom.

The meat avoiders. On the other end of the spectrum are the avoiders who mainly refrain from eating meat for health and ideological/religious reasons. Not eating meat is an important part of their identity, unlike lovers simply who see themselves as having a "normal" diet. The avoiders are often very devoted to their diets, enjoy getting new food information through their preferred channels and have a stronger chance to become a brand advocate. They are often higher educated and make up around 5% of the consumer population.

The meat reducers. In between the dietary groups of meat lovers and meat avoiders, falls the largest consumer group called meat reducers, accounting of 50-70% of the consumer population in the Netherlands and the UK (figure 1). The meat reducers are also called part-time vegetarians or flexitarians. The criteria to be a meat reducer is to have at least one meatless day a week. Unlike



the meat lovers, the meat reducers do not deem meat to be indispensable, and unlike the meat avoiders, they also do not see their own consumption pattern as a major part of their identity. The reducer rather enjoys the flexibility to eat meat if it fits the social setting or their mood. (1) (2) The reducer group is very heterogeneous in their ways of consuming less meat and their reasons for doing so, for example, 67% of the Dutch population says to have one or more meatless days per week (figure 1). The main reasons they gave for eating less meat were, the need for variation (37%), health (24%), the environment (23%) and animal well-being (20%). Additional reasons were financial (17%) convenience (9%), curiosity (8%), taste (7%) and the habit of the partner (3%). On their meatless days, the meat reducers often replaced meat with dairy or fish (37%) or plant-based meat substitutes (17%) or nothing at all (27%). (3)

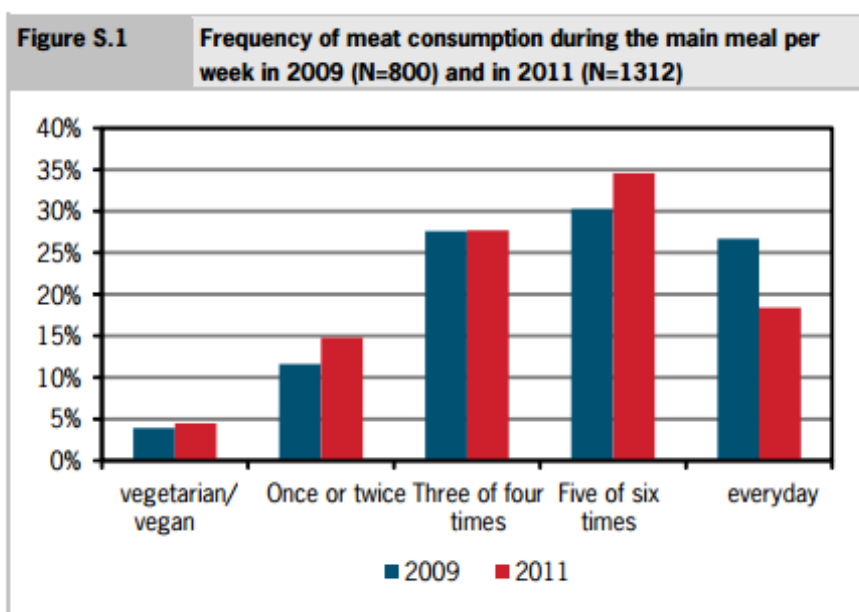


Figure 1 Shows the frequency of meat intake per week in the UK and Dutch population. (2)

1.2 The meat reducers are the group with the most growth potential

The meat reducers in the study appear as the group with the most growth potential for the transition from animal protein to plant protein. However, due to the heterogeneous nature of the consumer group, they do not have a clear social identity like in the other two groups. For example, Only 13% of the reducers identify themselves as flexitarian (2). This project can, however, help to map the different social identities for the meat reducers through a qualitative research. A more prominent social identity will make them more targetable for marketing strategies, and will allow product development to be tailored appropriately (1) (2) (4). Figure 2 demonstrates the different views of the

Hierarchy of foods by heavy meat-eaters	Hierarchy of foods by heavy meat-reducers
1. Chicken(breast)	1. Cheese / Cheese product
2. Beef	2. Chicken(breast)
3. Meatball	3. Egg
4. Chop (pork)	4. Salmon
5. Egg	5. Mushrooms
6. Cheese / Cheese product	6. Nuts
7. Fried fish fillet	7. Pulses
8. Salmon	8. Beef
9. Hamburger	9. Fried fish fillet
10. Minced-meat hotdog	10. Meatball
11. Mushrooms	11. Vegetarian meat substitute
12. Nuts	12. Hamburger
13. Pulses	13. Tofu
14. Vegetarian meat substitute	14. Chop (pork)
15. Tofu	15. Minced-meat hotdog

Figure 2 show Twigg's (1983) hierarchy of foods for heavy meat eaters and heavy meat reducers



hierarchy of foods between heavy meat eaters and heavy meat reducers. This specific question in the 2011 survey Dagevos (5), was inspired by Twigg’s hierarchy of foods, where meat (red meat and poultry) is at the top, followed by fish, eggs, and cheese. Here The animal based foods are higher in status than fruit, vegetables, and cereals, which are all at the bottom of the food hierarchy. Figure 2 also indicates the results that for meat-lovers the products of animal origin are on top in the food hierarchy. Twigg’s original hierarchy is corroborated in the study, as the top ten is completely made of animal foods, and the top four foods are all meat products. More interesting, however, is that the ratings of the heavy flexitarians differ greatly from Twigg’s original hierarchy of foods. First, the highest status is not reserved for a meat product, but rather for another (animal) products, such as cheese/cheese products. Second, plant-based protein products such as mushrooms, nuts, and pulses rank higher than some meat products, most notably beef. This ranking differs greatly from Twigg’s hierarchy (5).

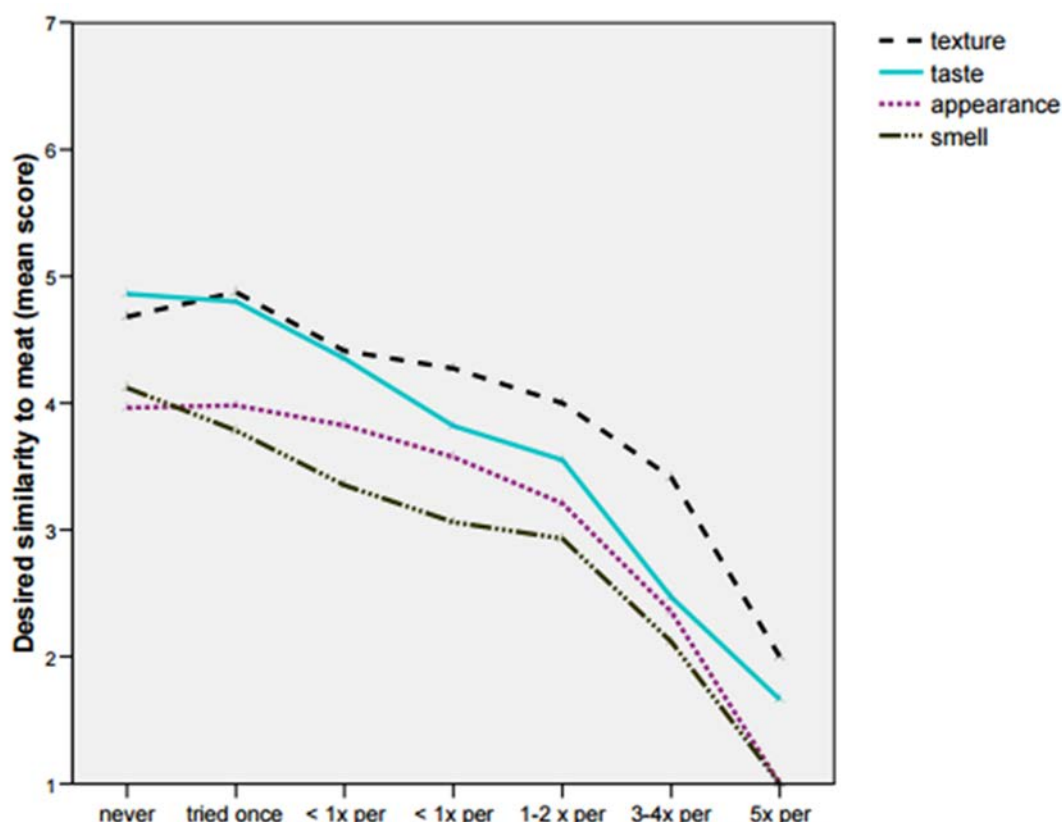


Figure 3 shows the desired similarity to meat for sensory attributes of new meat substitutes. Mean scores are displayed for the different levels of current meat (6)

The study of Hoek showed that, the more frequently consumer used meat substitutes, the less the substitutes needed to imitate meat. This indicates of a transformation of the concept of meat component in our diets. (6)



2 Activities for solving the task(s)

2.1 Targeted population recommendation

The study of De Boer (7) a Food Choice Motivation questionnaire (n=1083), showed a significant (P=0,001) clustering between people who would prefer lentils and beans snacks over meat or hybrid meat snacks, and people who are taste-oriented, like to try new foods things, and have an urban background and high level of education. (7) This is supported by the study of Hoek et al. (2011) who shows that light and heavy meat substitute users score low on the food Neo phobia (6). Things hampering the incorporation of plant-based meat substitutes in willing participants were “lack of familiarity” and “lack of skill to prepare them” (4). Finally, youngsters are among the most motivated groups to improve their diets, as 52% indicates: “I want to eat healthier in the future” (8). All the above information is considered with taking into account that with a meat cruder consumer panel we targeted population of the following demographics: people aged between 18-35, who live in an urban environment, who have an interest in trying new food types, and who consider themselves familiar with social media. Because they will be selected for their meat reducer mind-sets there will be a bias against meat consumption but this should not conflict with study design as aim to map the responses on non-meat products. A second bias may have occurred as most participants were (ex) students of a Wageningen University which specializes in ‘healthy food and living environment.

2.2 The discussion guide and research protocol for consumer decisions in targeted populations

For the consumer panel, we have opted for a qualitative live test situation rather than an online forum, because in our previous experience this yields much better results and is more in line with our expertise. The consumer test panel included 28 people, who fall into the category of meat reducers, who are early adopters. This group was chosen because they were identified as the “early adopters” and “early majority” in the acceptance of new plant protein products (6).

The goal of this study is to explore the food landscape and opportunities for novel plant protein products. Based on the research of Dagevos (1) and Hoek (6), the key barriers and drivers concerning the acceptance of meat substitutes and novel plant protein products have been identified. According to the two studies the main key barriers and drivers for meat substitutes are:

Barriers

- Fear of new food types (High score in Neo Food phobia)
- Sensory: Textures, taste, smell, look
- Food identity (Meat lover)
- Unfamiliarity with the product and how to prepare it



Drivers

- Openness to new foods (Low score in Neo Food phobia)
- Food identity (meat avoiders only)
- Reduction of the environmental footprint
- Animal well-being
- Health

The meat reducers make up 50-70% of the population, and are currently open to reducing and replacing meat with other options. We attempted to reduce the barriers as much as possible by selecting consumers who can prepare the product themselves, accompanied by recipes of how to prepare the products. Within the meat reducer group, a further selection was made based on traits that correlate with being an “Early Adopter” and “Early Majority” for novel protein foods. These sub-groups within the consumer group were based on the “Diffusion of innovation model” by Rogers, shown in Figure 4. The majority of the consumers in the Early Adopters and Early Majority sub-groups have a neo food phobia score under 40, are between 18 to 35 years old, and live in an urban environment. (7)

- A novel food phobia score under 40
- Being between 18-35 of age
- Living in an urban environment

By removing as many barriers as possible, we strive to unearth novel opportunities for the plant protein industry that focus on the highest potential target group of Meat Reducers.

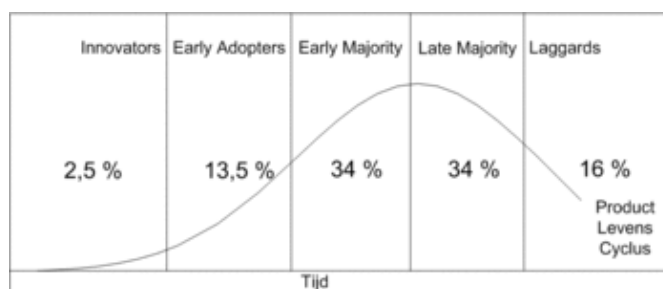


Figure 4 Diffusion of innovation model from Rogers (14)

2.3 Product groups with plant protein in relation to consumer behaviour and acceptance

Plant proteins can be applied in several different products categories. In collaboration with the WP3 partner, 14 product categories were chosen to be incorporated in the questionnaires, and 11 products were tested in a home setting. The product categories were grouped as follows:

2.3.1 Meat replacers

It concerns products that aim to replace the role of meat as part of a meal component in a dish. The three subcategories that were tested were: “Very similar to meat, (high-quality imitation)”, “Not similar to meat (vegetable burger)” and “Traditional meat replacements like tofu.”

2.3.2 New snack and bites concepts with plant protein

The snack market is constantly evolving. People are looking for healthy, sustainable snacks with a feel good story. The subcategories that were tested were “Savoury bean snack” and “sweet snacks” like biscuits (only in the questionnaires).



2.3.3 Replacement/enrichment of staple food

In this category, staple foods that are part of the most European diets such as bread, cereals, pasta, milk and spread, are either enriched with or replaced by plant protein. The subcategories that were tested here are "Protein enriched pasta," "Protein enriched bread," "Protein enriched plant milk," and "Protein enriched breakfast cereals"

2.3.4 New sources of plant protein: lupine bean

Lupine is an old traditional snack in Southern Europe and has been used as a bread additive in most European countries. However, most European consumers are not familiar with the sweet lupine bean that can be consumed in a similar fashion as white beans or chickpeas. In order to test their reactions, a category of Lupine beans in glass were tested and a category of dried chopped Lupin, with a similar function to rice or oats, were tested.

2.3.5 New meal easy concepts

Meal solutions and readymade meals are a big part of today's consumer market. There is currently a rise in demand for healthier options within this category as well as options with a feel good story. Products tested in this category are Chickpea curry in a bag and Quinotto.



3 Results

3.1 The pre-test

In the pre-test the study population is described. The panel members were recruited through social media. In total, 31 people applied for the study, and 30 were accepted based on the criteria. Two of the accepted people dropped out later. 28 finished all the questionnaires and participated in the focus group discussion. Of the 28 participants were 64% female. The average age was 27 with (SD 5) and the Neo Food Phobia score was 23 (SD 6). 25% were considered Neo Food Phillic (attracted to trying new food concepts) with a score below 20. (Table III) The participants were asked what their motivation was for not eating meat at least once a week, and the answers are summarized in table IV

Table III Demographics

Demographics	Total n=28	% or average (SD)
Gender		
- Male	10	36%
- Female	18	64%
Age (in years)	28	27 (4,6) Range 19-35
Education level		
- Bachelor	12	43%
- Master/doctorate	16	57%
Living arrangements		
Lives with partner	9	32%
Lives with partner and children	2	7%
Lives alone	3	11%
Lives with roommates	13	46%
Lives with parents	1	4%
Employment status		
Employed	15	54%
Student	9	32%
Self employed	1	4%
Unemployed	2	4%
Unable to work due to chronic health issues	1	4%
Full time caretaker of the household	0	0%



3.2 Inclusion criteria and background information

Table IV shows that consumer panel was successfully selected through a pre-test on the criteria stated in the research strategy. A large part of the consumer panel (25%) could be considered neo food phillic (attracted to trying new types of food) with a neo food phobia score under 20. All panel members ate meat less than 7 days a week. On average they ate meat 2.1 one days a week. When asked with what the panel members replaced meat in their meatless days, pulses ranked second with 50% of the answers. Meat substitutes (Very similar to meat) ranked fourth place with 32%, and meat substitutes (not similar to meat) ranked seventh. Quinoa and amaranth 21% ranked eight with 14%. When asked in an open question what their motivation was for cutting down meat consumption, the panel members often gave a combination of several reasons. Most predominantly, meat consumption was cut down due to environmental concerns, often paired with concerns about the bio industry and animal wellbeing, as well as consumer feeling that it was not needed to eat meat every day (reference to a figure/table here). 22% of the panellists indicated health concerns as their motivation. In fact, the WHO report about the increasing risk of cancer with consuming red meat (Reference the report here) was often mentioned, as well as the fear for antibiotic residue and resistant bacteria. Lastly, financial reasons (11%) and variation (7%) were mentioned as motivations for reducing meat consumption.

Table IV Perceptions and behaviour of the consumer panel regarding meat and meat substitutes n=28

Inclusion questionnaire	% or average (SD)
Neo food phobia score (scale 10-70)	23 (6)
Average days of meat consumption per week	
Vegetarian	10%
1-2 days	53%
3-4 days	33%
5-6 days	4%
7 days	0%
With what did you replace the meat with those days	
Fish/ Sea fruits	54%
Pulses	50%
Dairy (Cheese/cream)	46%
Meat substitutes (Very similar to meat)	32%
Nuts	29%
Mushrooms	25%
Not similar to meat (vegetable burger)	21%
Quinoa, Bulgur or Amaranth	14%
Traditional (tofu, tempeh)	11%
Nothing	7%



Seeds	4%
What was your motivation for not eating meat at least once a week?	
Environmental concerns	78%
Animal well-being	41%
I don't need it	30%
Health	22%
Financial	11%
Variation	7%

3.2.1 Future roles for pulses and quinoa

In the pre-test, the consumer panel members were asked to rate on a scale of 1-7 “where do you see a role for pulses and quinoa in the future.” Salad and meat substitutes (not similar to meat) and cereal replace (quinoa only) were the top 3 roles chosen by the panel (Figure 5). It also showed that most consumer panel members prefer pulses in the categories of meat substitutes (similar to meat) (by 0.8 points) and meat substitutes (not similar) (by 0.6 points). The panellists prefer quinoa in the categories of Snack (0.6 point) and grain and cereal replacement (1.0 point).

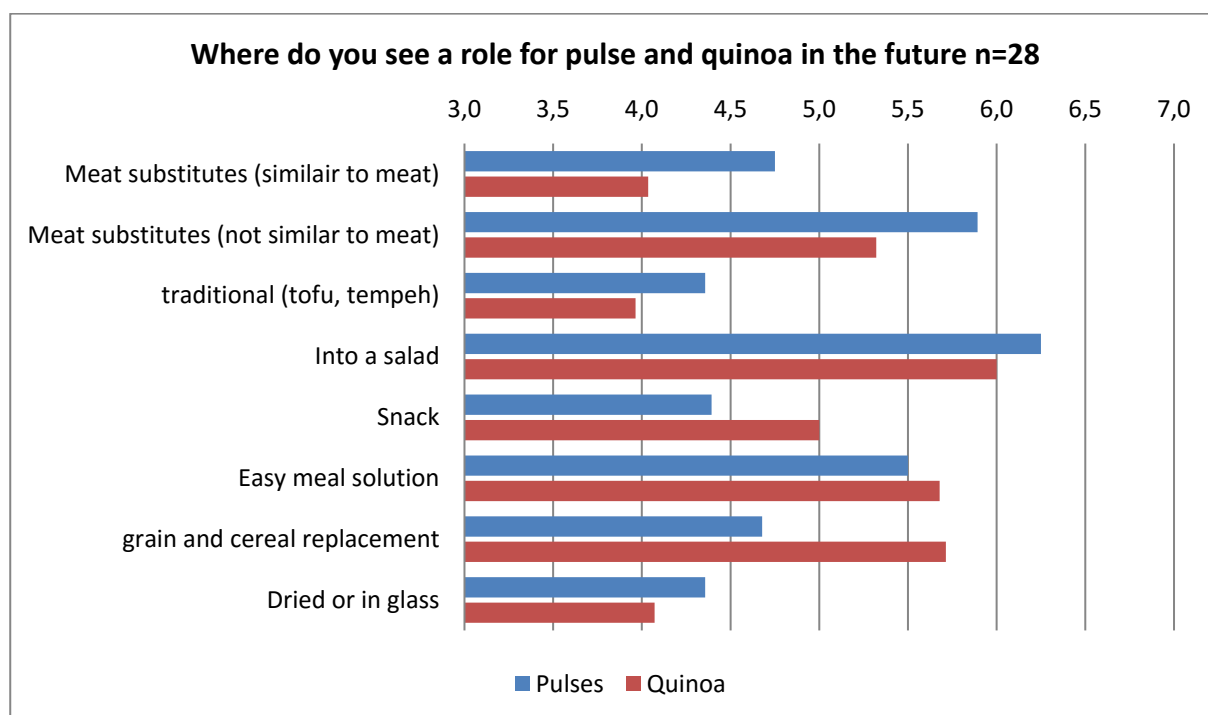


Figure 5 In the pre-test, the consumer panel members were asked to rate on a scale of 1-7 “where do you see a role for pulses and quinoa in the future?”



3.3 The live test situation

All panel members received a neutral looking cardboard box with 11 plant protein products (Table V) and an instruction booklet with recipe suggestions, which they had to test in a three weeks period. After testing each product the panellists would report their experiences through a food dairy questionnaire. The result of the questionnaire contained a quantitative part in chapter 3.4 and a qualitative part in chapter 3.5.

Table V Description subcategory of tested products

	Group
<p>Very similar to meat, (high-quality imitation) Product to be tested in this category is the “Kipstuckjes” tested in WP3.1</p>	Meat substitutes
<p>Not similar to meat (vegetable burger) Product to be tested in this category is the Quinoa burger from WP3 SME NatureCrops</p>	
<p>Traditional meat replacement like tofu and tempeh Product to be tested in this category is “Lupine based Tempeh” from Bumi Organics</p>	
<p>Snacks Savoury Product to be tested in this category is the “Fava bean snacks” form the Albert Heijn</p>	Snacks
<p>Snacks Sweet Only tested in the questionnaires. Example sweet snacks like biscuits</p>	
<p>Protein enriched pasta The protein enriched pasta from Tasty basics</p>	Staple food (Plant protein based of enriched version)
<p>Protein enriched bread The protein enriched and fibre bread from Tasty basics</p>	
<p>Protein enriched plant milk and smoothie Only tested in the questionnaires. Example soymilk or quinoa milk</p>	
<p>Protein enriched breakfast cereals Only tested in the questionnaires. Example fortified oats and muesli</p>	
<p>Beans/Seeds emulating a specific dish like couscous and risotto Products is this category will we “Quinotto” risotto based on quinoa from WP3 SME NatureCrops</p>	Meal solutions integrating beans and seeds
<p>Easy meal solution, Beans “made easy” cooked with sauce Product to be tested in this category is the “Chickpea curry” from Boon</p>	
<p>Lupine beans in glass Product to be tested in this category is “lupine in glass” as salad garnish from WP3 SME mfh Pulses</p>	Sweet lupine beans as new protein source
<p>Lupine beans dried and chopped Product tested in this category were “lupine bites” which are chopped dried lupine beans that can be used as rice, oats or coarse flour from Lupin.eu</p>	
<p>Pulse-based spread Product to be tested in this category is "Lupilove Curry Spread"</p>	



3.4 Quantitative analysis of the product questionnaires

Here the consumer panel members could score the products on a scale of 1-7, depending how far they agreed with each of the following statements:

- I considered this product to be very tasty
- I was familiar with this product
- I found this product easy to prepare
- I would recommend this product to my friends and family

The quinoa burger was considered to be the tastiest option. Three of the four Lupine products scored at the bottom of the taste test. The Lupine Love Lupine based curry spread, however, scored second place in the taste test (Table VI). An observation, on the order of which the products were tested in the 3 weeks period, showed that the lupine beans in glass as well as the dried and chopped lupine beans were often the last products to be tested by the panel members. These two products also scored lowest on familiarity (Table VI). The optional recipe suggestion was followed more often when preparing these two lupin products than any other product. Lack of skill did not seem to have a negative influence on any of the products except the dried and chopped lupine beans, which was the most novel item. The lack of familiarity and skill were perhaps increased by the breakfast recipe suggestion, as having beans for breakfast is uncommon in Dutch culture.

Table VI Products tested in home setting (scored on a scale of 1-7)

	n=28	Tasty	Familiar	Easy to prepare	Recommend
1.	Quinoa burgers	6,0	2,8	6,5	5,9
2.	Lupi love spread curry flavour	5,9	1,9	6,8	5,7
3.	Fava bean snack soy sauce flavour	5,8	2,0	6,5	5,3
4.	Quinotto	5,8	3,2	6,0	5,4
5.	Vegetarian chicken	5,6	4,8	6,5	5,8
6.	Protein enriched bread	5,6	1,9	6,8	5,5
7.	Chickpea curry in a bag (readymade)	5,4	2,1	6,8	4,9
8.	Lupin beans in glass	4,9	1,5	6,5	5,1
9.	Lupin Tempeh	4,5	2,6	6,1	4,6
10.	Protein enriched pasta	4,3	2,0	5,9	3,9
11.	Lupin beans dried and chopped	3,4	1,3	3,9	3,2



3.4.1 Price indication given by the consumer panel members

The consumer panel members were asked to indicate what they were willing to pay for the product as a minimum amount (what the consumer would consider a safe and fair amount), and as a maximum amount for the product (Table VII). In the price estimation, it became apparent that the consumer panel members in general were willing to pay lower amount on average for the products than what they are currently available for. For the three products of Lupi Love spread, the quinotto and the vegetarian chicken, the actual price was higher than the consumer panel members maximum amount willing to pay. When a product functions as a replacement/imitation for another product, as these meat replacing products do, there is a strong aversion towards paying a significantly higher price than the original product.

Table VII Product price willing to pay

n=28	Minimum amount	Maximum amount	Average amount	Actual consumer price*
Quinoa burgers	€ 1,88	€ 3,52	€ 2,70	N.A.**
Lupi love spread curry flavour	€ 1,39	€ 2,34	€ 1,86	€ 2,50
Favabean snack soy sauce flavour	€ 0,79	€ 1,60	€ 1,19	€ 1,00
Quinotto	€ 1,21	€ 2,14	€ 1,67	€ 3,49
Vegetarian chicken	€ 1,97	€ 3,25	€ 2,61	€ 4,00
Protein enriched bread	€ 1,18	€ 2,14	€ 1,66	€ 1,79
Chickpea curry in a bag (readymade)	€ 1,84	€ 3,26	€ 2,55	€ 2,99
Lupin beans in glass	€ 0,94	€ 1,76	€ 1,35	€ 1,79
Lupin Tempeh	€ 1,40	€ 2,40	€ 1,90	N.A.**
Protein enriched pasta	€ 1,04	€ 1,96	€ 1,50	N.A.**
Lupin beans dried and chopped	€ 1,16	€ 2,08	€ 1,62	€ 2,50

*The actual consumer price as known to the researcher at the moment of testing **Not available (N.A)

3.5 Qualitative analysis of the product questionnaires

A qualitative analysis was done with an open question of “What did you like about the product and what did you not like about the product?” The results are discussed per product group.

3.5.1 Meat replacers

Products in this category aim to replace the role of meat as part of a meal component in a dish. The three subcategories of products that were tested were 1) Very similar to meat, (high-quality imitation), 2) Not similar to meat (vegetable burger) and 3) Traditional meat replacement products, such as tofu. Products represented for each three subcategory and the answers given in the questionnaires are discussed below.



3.5.1.1 *Very similar to meat: Vegetarian chicken pieces*

Product description: The products tested in this category were the non-marinated “kipstuckjes”, chicken pieces from the Vegetarian Butcher. The Vegetarian Butcher specialises in developing and producing soy-based meat replacers that are indistinguishable from their meat counterpart.

Likes and dislikes by consumer panel members: The chicken pieces were judged by almost all panel members as a worthy meat substitute in terms of texture and taste. They were seen as one of the few meat replacers that actually come close to chicken. The chicken pieces get a crispy crust when baked in oil and easily take up the taste of added herbs, sauces or marinades. Advantages often mentioned were that they are easy to prepare (for example with rice and sauce), and while it does not exactly taste like real chicken, it has a good, full taste that does come close. One panel member described the taste as ‘delicious, rich, almost nutty flavour, something that I have not tasted before’. The structure/texture of the product was found well-imitated chicken-like with a good bite, however slightly tougher. A plus was that there are no rare/unnecessary added ingredients, the product is saturating and seems healthy. A disadvantage often mentioned was that the size of the pieces is too big.

3.5.1.2 *Not similar to meat: Quinoa burgers*

Product description: The product tested in this category was the Quinoa burger from WP3 SME Nature Crops, the grilled vegetable flavour. The aim of the quinoa burger is to have a role in the meal component without trying to imitate meat.

Likes and dislikes by consumer panel members: The quinoa burger was considered to be the tastiest option in the qualitative analysis (Table VII), however, the taste did not resemble meat. Some panel members did not mind this however, as they did not find it necessary for the product to taste like meat. The burgers were said to have a good texture and taste, compared to other similar products. One panel member, who had not appreciated quinoa before, said that the burger showed that quinoa could actually be very tasty. In terms of the seasoning and spices the opinions were mostly divided; some said that more salt or flavour could be added, as stated one panel member: ‘I found that the taste was a bit mild for a hamburger, the taste could have been a little more spicy and powerful’. Others stated the burger to be deliciously spiced: ‘A rich, powerful taste, tasty herbs combination’. According to the panel members, the structure was good (little crispy from the outside, juicy inside), but some also found the inside was a bit too soft/juicy. The burgers were found easy to prepare, to get crispy easily, and to remain compact with good texture (does not break apart and is not granular). Positive was that the product can be consumed in a variety of ways and it was found suitable for multiple moments (morning, noon and evening). The product seems healthy with different nutrients in the product (combination of quinoa and vegetables). Most panel members found the burger to be too small.



3.5.1.3 *Traditional meat replacer: Lupine based Tempeh for BUMI organic*



Product description: The product tested in this subcategory was tempeh made with lupine beans (traditionally soybeans are used). Although the product could also be placed into the Lupin bean subcategory, its main role in the dish is to replace the meat component and was, therefore, placed here. Traditional meat replacers have been around for thousands of years and are perceived by the consumer as an alternative category for meat.

Likes and dislikes by consumer panel members: The lupine based tempeh was considered as a reasonable replacement or alternative for meat and soy-based tempeh. The product is easy to prepare, and due to the quite neutral taste, it can be prepared in many different ways. Unlike the soy variant, the lupine tempeh does not have a sour taste which is found positive. According to the panel members, the lupine tempeh tasted fine but was somewhat flavourless and tasteless without any added herbs. The structure was appreciated by many (crisp on the outside, soft on the inside), but some said it had too little bite and would prefer less soft and sticky.

3.5.1.4 Associations for the phrase “natural source of plant protein or enriched with plant protein” within the category Meat replacers

In order to elucidate if consumer panel members liked consuming and being informed about extra protein in the different product subcategories, the consumer panel members were asked “What do you expect when you read the phrase ”source of plant protein” or “enriched with plant protein”. The panel members were asked to answer to the question by choosing, a maximum of five, from the following traits:

- Soy was added to this product
- Sense of increased satiation is expected
- Light or low fat compared to similar products in this category
- It will be less tasty than similar products in this category
- It will be more tasty than similar products in this category
- It will be more expensive than similar products in this category
- It will contain extra nutrients like amino acids and extra vitamins
- It will be positive for gut health
- It will stimulates muscle growth
- It will be more sustainable similar products
- It will be overly processed compared to similar products
- Something else (open question)

Some of these traits are positive and others are negative or neutral. The average chosen frequency of each trait of all the products together tells something about plant protein perception in general. While the deviations of the average associations for the separate subcategories tells us something about how a product is perceived within its category. Per product category, a table was created showing the average association of all products combined compared to the specific association per subcategory. (Tables VIII to XII) If a deviation of 10% or more was present for a specific product compare to the average of all products combined it was considered a product specific trait. Interpretation of these traits depends on how one wants to position the product in the market.



In Table VIII associations for meat replacers, it shows that the phrase “source of plant protein” showed an increased association (more than 10% deviation) for having soy added to the Vegetarian chicken. While “increased satiation” is lower overall the subcategories. “Less tasty” is higher than average in the Vegetarian chicken. Lupin tempeh scores lower in the “expect is to be expensive” category. Vegetarian chicken is considered to be less good for gut health. The Quinoa burger and the Lupin tempeh scored a lot higher on the sustainability association. Lupin tempeh is not at all associated with being overly processed. The category “other” was an open question for the consumer panel members to answer, who mostly stated expecting the meat replacers to be healthier than meat (Table VIII).

Table VIII Traits chosen for meat replacers in combination with the phrase “source of plant protein” for the different subcategories compared to similar products.

Traits to choose from (n=28)	Total average	Quinoa burgers	Vegetarian chicken	Lupin Tempeh
Soy was added to this product	26%	25%	40%	18%
Sense of increased satiation	36%	25%	18%	11%
Light or low fat	7%	7%	7%	7%
Less tasty	13%	4%	25%	14%
Tasty	16%	18%	22%	25%
Expensive	30%	29%	36%	18%
Extra nutrients	25%	32%	29%	18%
Positive for the gut	27%	32%	14%	29%
Stimulates muscle growth	30%	36%	29%	32%
Sustainable	39%	58%	43%	61%
Overly processed	12%	7%	7%	0%
Other (open question)	22%	25%	22%	22%

*If a deviation of 10% or more was present for a specific product compare to the total average of all products combined it was considered a product **specific trait**.*

3.5.2 New snack and bites concepts with plant protein

The snack market is constantly evolving. People are looking now for healthier, sustainable snacks with a “feel good story.” The subcategories tested were a Savoury baked fava beans snack and sweet snacks, similar to biscuits (only in the questionnaires).

3.5.2.1 Savoury Snacks: Soy sauce flavoured fava bean snacks

Product description: Baked fava beans in soy sauce are crispy and sold in the nuts and chocolate bars section in the supermarkets next to the counter. A bag contains 65 grams, serving 1-2 portions and 14.3 grams of protein. In the Netherlands, there is no cultural history of eating fava beans outside the evening meal as a vegetable component. Yet in the quantitative analysis in Table VI the snack was considered the third tastiest product.

Likes and dislikes by consumer panel members: According to the panel members, the fava bean was well suited for a snack, and to be offered in a birthday party for example. However, after a while, the beans became boring and required maybe to be combined with other nuts or in a mix. The panel members felt that the snacks offered the beans in its original form had a good texture, size, shape and



were crispy. The taste is salty and sweet at the same time, and even though beans are not normally preferred this way, the panel members liked the snack. The taste was good at first, but a less appreciated after taste, which was considered a bit dry and mild after chewing. Some participants mentioned it made them a bit thirsty. Most mentioned the disadvantage of the product to be the nutritional values containing saturated fats and added sugar, modified starch and palm oil. It made the product feel less healthy and not suited as a primary source of protein.

3.5.2.2 Associations for the phrase “natural source of plant protein or enriched with plant protein” within the snack category

In Table IX Associations for snacks, it shows that the phrase “source of plant protein” showed an increased association (more than 10% deviation) for having soy added in both sweet and savoury snacks. The added soy was perceived negatively by the consumer panel members. Sweet snacks scored more than double in the “less tasty category,” showing that this consuming panel assume that having plant protein added to sweet snacks will reduce the taste of it. Both snacks are less associated with containing extra nutrients of protein, either added/naturally present. Sweet snacks are also less associated with a positive effect on the gut health. 43% of the panel members associated “stimulates muscle growth” with savoury snacks, in comparison to 30% on average and 25% with sweet snacks (table IX). This pattern is even more extreme with the “sustainable” category, where savoury protein-rich snacks scored 54%, in comparison to 39% in average, and 18% of answers for a sweet protein-enriched snack. Lastly, sweet protein-enriched snacks have a higher chance than average to be considered overly processed (29% vs. 12%) (Table IX). In the open question section, it became clear that some consumer panel members disliked the amount of salt and sugar added to the savoury snack.

Table IX Traits chosen for snacks in combination with the phrase “source of plant protein” for the different subcategories compared to similar products.

Traits to choose from (n=28)	Total average	Savoury Snacks	Sweet snacks
Soy was added to this product	26%	36%	40%
Sense of increased satiation	36%	32%	36%
Light or low fat	7%	11%	7%
Less tasty	13%	7%	29%
Tasty	16%	11%	7%
Expensive	30%	25%	32%
Extra nutrients	25%	14%	11%
Positive for the gut	27%	22%	7%
Stimulates muscle growth	30%	43%	25%
Sustainable	39%	54%	18%
Overly processed	12%	11%	29%
Other (open question)	22%	11%	18%

*If a deviation of 10% or more was present for a specific product compare to the total average of all products combined it was considered a product **specific trait**.*



3.5.3 Replacement/enrichment of staple foods

In this category, a selection of staple foods that are part of most European diets like bread, cereals, pasta and milk, are either enriched with or replaced by plant protein products. The subcategories that were tested here are: Protein enriched pasta, Protein enriched bread, and Protein enriched breakfast cereals.

3.5.3.1 *Staple food: Protein enriched bread*

Product description: Bread from ‘Tasty Basics’, which has extra protein and fibres, and 80% less carbohydrates than average bread. Tasty basic is a company that redesigns everyday products to contain fewer carbohydrates and more protein and fibres. This bread has a similar shape and size to rye bread, instead of the airier normal (yeast) bread.

Likes and dislikes by consumer panel members: This bread was said to have a good and rich taste, and a good structure as of the panel members felt that the nuts and seeds gave the bread a good bite. Many participants said the structure/texture and the taste is very similar to rye bread, but with a lighter taste, which was perceived positive. In fact, several participants preferred this bread over rye bread. Especially in terms of nutritional value (rich in protein and low in carbohydrates), the bread was conceived as a good and healthy replacement for normal bread. For many, it was also a good replacement for rye bread, but in structure it was a bit too fibrous to replace normal bread. Also positive remarks were that the bread gives a long-lasting saturated feeling. The disadvantages were that the bread is packed

5 slices/package, which causes excessive plastic waste and possibly makes it relatively expensive.

3.5.3.2 *Staple food: Protein and fibre enriched pasta*

Product description: Pasta from ‘Tasty Basics’ with extra protein and fibres and less carbohydrates compared to regular pasta. Tasty basic is a company that redesigns everyday products to contain fewer carbohydrates and more protein and fibres. This pasta was still under development when the study was conducted. The cooking time was currently 22 minutes, but the goal was to reduce this.

Likes and dislikes by consumer panel members: While participants testing the products felt that it was said a nice idea, several found the pasta unpleasant in flavour, taste and texture, and would not use the product as a replacement for normal pasta. Some participants found the texture and taste sufficient, but the taste of normal pasta better. The structure and taste of the pasta was hard to define, but many stated it to be more tough, rough and dry than normal pasta. A big plus of the product was the nutritional value, and that the product is healthy (contains extra fibres and proteins) and saturated very well. A big disadvantage was the cooking (22min) time that is much longer than normal pasta.



3.5.3.3 Associations for the phrase “natural source of plant protein or enriched with plant protein” within the enriched staple food category

In Table X Associations for staple food shows that the phrase “enriched with plant protein” showed an increased association (more than 10%) for soy added in the subcategory “plant milk and smoothie”. Protein enriched bread and pasta scored higher in satiation, and protein enriched pasta was considered less tasty. Protein enriched bread and breakfast cereals were more than average associated with being expensive (Table X). Only protein enriched bread was associated with having a positive impact on the gut. Plant milk and smoothies enriched with protein were more than average associated with the phrase “stimulates muscle growth.” Protein enriched pasta was less associated with “sustainability” 14% than average 39%. Pasta, plant milk and breakfast cereals were all three more associated with “Being overly processed” compared to similar products without the phase protein added/ natural source of protein.

Table X Traits chosen for staple food were either enriched of a natural source of plant protein in combination with the phrase “source of plant protein” compared to similar products.

Traits to choose from (n=28)	Total average	Protein enriched bread	Protein enriched pasta	Plant milk and smoothie	Breakfast cereals
Soy was added to this product	26%	25%	22%	51%	29%
Sense of increased satiation	36%	47%	51%	32%	43%
Light or low fat	7%	7%	4%	7%	0%
Less tasty	13%	14%	25%	11%	14%
Tasty	16%	22%	11%	11%	11%
Expensive	30%	43%	25%	29%	47%
Extra nutrients	25%	25%	25%	25%	25%
Positive for the gut	27%	40%	29%	25%	32%
Stimulates muscle growth	30%	29%	36%	43%	29%
Sustainable	39%	29%	14%	36%	22%
Overly processed	12%	11%	22%	22%	29%
Other (open question)	22%	29%	25%	25%	22%

*If a deviation of 10% or more was present for a specific product compare to the total average of all products combined it was considered a product **specific trait**.*

3.5.4 Meal solutions with new plant proteins

Meal solutions and readymade meals are a big part of today’s consumer market. There is currently a rise in demand for healthier option within this category, as well as option with a feel good story. Products tested in this category are Chickpea curry in a bag and Quinotto.



3.5.4.1 *Chickpea curry in a bag*

Product description: The chickpea curry from Boon is a model example of a product that meets the need of the current market. They have a “feel good” brand story as a millennial start-up company, working together with local organic farmers to create healthy meatless minimally processed meals. The product has a clean label policy, and the ingredient list shows an asterisk behind the carbohydrates (of which are sugar)*, and shows which sugars are naturally occurring within this product.

Likes and dislikes by consumer panel members: Most consumer panel members found it easy to prepare and enjoyed the spices and consistency. Although some considered it too spicy or too bland, they liked the story behind the product and the healthy feeling it gave them. However, some people did not see an added benefit of the meal solution as they would easily whip up a curry themselves.

3.5.4.2 *Quinotto (quinoa based risotto)*

Product description: Quinotto is a quinoa based product from WP3 SME Nature Crops. The Quinotto is an organic meal solution that serves as a new take on a traditional risotto dish. It consists of quinoa and a spices mix. In preparation, it is very similar to regular quinoa and only requires water and does not require white wine, cheese or stock as regular risotto does.

Likes and dislikes by consumer panel members: The season of the quinotto was well like although some struggled to pair it with other flavours if they had not tasted it before creating a barrier for their product. Also some people preferred to spice the quinoa themselves. The product was found to be light on the stomach and less creamy than regular risotto. This disappointed some participants.

3.5.4.3 *Associations for the phrase “natural source of plant protein or enriched with plant protein” within the category easy meal solutions*

In Table XI Associations for meal solutions it shows that the phrase “source of plant protein” showed a decreased association (more than 10% deviation) for the trait “soy added”. This may be caused by having another clear source of plant protein in the front of the package. The quinotto scores 0% at the negative association “less tasty” in connection to the phrase “natural source of protein” and higher at the positive association “contains extra nutrients.” The chickpea curry scored higher (40% vs. 30%) than the average with the association of “stimulates muscle growth” (Table XI).



Table XI Traits chosen for easy meal solutions in combination with the phrase “source of plant protein” compared to similar products.

Traits to choose from (n=28)	Total average	Chickpea curry in a bag	Quinotto
Soy was added to this product	26%	0%	7%
Sense of increased satiation	36%	43%	36%
Light or low fat	7%	4%	4%
Less tasty	13%	4%	0%
Tasty	16%	18%	11%
Expensive	30%	32%	32%
Extra nutrients	25%	22%	36%
Positive for the gut	27%	25%	25%
Stimulates muscle growth	30%	40%	18%
Sustainable	39%	43%	43%
Overly processed	12%	7%	4%
Other (open question)	22%	29%	25%

If a deviation of 10% or more was present for a specific product compare to the total average of all products combined it was considered a product specific trait.

3.5.5 New sources of plant protein: lupine bean

Lupine is an old traditional snack in Southern Europe and has been used as a bread additive in most European countries for the past couple of years. However, most European consumer panel members are not familiar with the sweet lupine bean that can be consumed in a similar fashion as white beans or chickpeas. In order to test their reactions to different forms of Lupin beans the subcategories Lupine beans in glass, Lupi Love curry spread, and the subcategory of dried chopped lupin beans (with a similar function to rice or oats), were tested.

3.5.5.1 White Lupin beans in glass

Product description: White Lupin beans in glass are sold under the home brand of the organic supermarket chain Ekoplaza. They are cooked and only require heating before consumption. Lupin beans are not part of Dutch cuisine.

Likes and dislikes by consumer panel members: In general, the consumer panel members were a rather neutral towards the beans. They did not like nor dislike them, and considered the beans on their own a bit boring/flavourless. Due to the unfamiliarity, they struggled to find a good combination with other flavours. Lupin beans have a bite and certain firmness to them. Opinions were split whether this was a good thing or not. The beans were considered to be in the middle ground between chickpeas and white beans.



3.5.5.2 *Dried and chopped lupin: Lupine bites*

Product description: Dried chopped Lupin beans with a similar function to rice or oats. The smaller size reduces the required soaking of the bean and reduces the cooking time to 20 minutes, in comparison to whole dried Lupin beans. The product is developed by a small start-up company called Lupin Food

Likes and dislikes by consumer panel members: The SME Lupin Food supplied a sweet oatmeal like breakfast recipe with the Lupine Bites. The lack of experience led to more adherence to the recipe suggestions. The consumer panel members found that the cooking time of 20 minutes was too long for a breakfast dish. The firm bite was also not appreciated in an oatmeal context. However, in a savoury lunch/ dinner context the consumer panel members enjoyed the product more. Flavour wise the consumer panel members were divided.

3.5.5.3 *Lupi love curry, a lupine based spread*

Product description Lupi_love is a range of organic spreads meant to be eaten as a dip on bread. The product is made by Zwergenwiese, which is based in Germany. The tested flavour of the Lupi love spreads was curry.

Likes and dislikes by consumer panel members: The product had a strong curry flavour that most consumer panel members liked, but some found it too strong. The consumer panel members, in general, liked the texture and appreciated that it was not too oily. It was easy to use and match with other food groups.

3.5.5.4 *Associations for the phrase “natural source of plant protein or enriched with plant protein” within the lupin category*

Table XII Associations for Lupin products, it shows that the phrase “source of plant protein” showed an increased association (more than 10% deviation) for the association “increased satiation” for the lupine beans dried and chopped. The association with the “less tasty” category was twice as much for the dried and chopped lupine beans in comparison to the total average (table XII). The association “expensive” was lower for the Lupi Love spread. What is remarkable is that within the association with the category “contains extra nutrients”, the Lupin beans in glass score (18%), lower than average (25%), while lupine beans dried and chopped scored higher than the average (36%) (Table XI). Whereas the association on “positive effect on gut” showed a different pattern with lupine beans in glass scoring higher (43%) than average (27%) and lupine beans dried and chopped (32%). Both Lupin in glass and lupine dried and chopped scored more than 50% lower on the association “stimulates muscle growth.” Lupine beans in glass were considered to be more sustainable than average, and the curry spread less so. Lupine beans in glass scored 0% on the association “overly processed” (table XII).



Table XII Associations for meal solution	Total average	Lupin beans in glass	Lupin beans dried and chopped	Lupilove spread curry flavour
Soy added	26%	*	*	25%
Increased satiation	36%	43%	47%	36%
Light	7%	11%	14%	4%
Less tasty	13%	4%	32%	0%
Tasty	16%	18%	18%	18%
Expensive	30%	22%	25%	18%
Extra nutrients	25%	18%	36%	29%
Positive for the gut	27%	43%	32%	18%
Stimulates muscle growth	30%	14%	14%	25%
Sustainable	39%	54%	43%	29%
Overly processed	12%	0%	4%	11%
Other	22%	18%	18%	14%

*If a deviation of 10% or more was present for a specific product compare to the total average of all products combined it was considered a product specific trait. *Because these products were visibly pure and clearly not associated with soy, in the questionnaires “has soy added” question was not asked.*



4 Focus group discussions

At the end of the three-week testing period, 28 participants attended the focus group discussion in a setting of an average of 9 people. During the discussions, it became clear that within the young urban meat reducers group, two sub-profiles emerged with very different motivations for their meat reduction. These sub-profiles showed very similar traits with the consumer profiles presented by Motivaction on the Green Protein Event 2017 Pieter-Paul Verheggen and Clasine van der Wal. Because of the similarities of both sub-profiles, the Motivaction description will be used to explain the different motivations in both groups. (9)

4.1 Consumer profiles within the meat reducer group

Motivaction (year) specialises in consumer behaviour and trends using a mentality model, which is a tool that maps consumer panel members based on their values and lifestyle choices. (10). In 2017 Motivaction was asked by the Green Protein Alliance (a platform to support the consumption of plant protein) to create consumer profiles interested in plant protein products. They held a questionnaire among 512 consumer panel members. (figure5) Two clear profiles that had an interest in plant protein emerged.

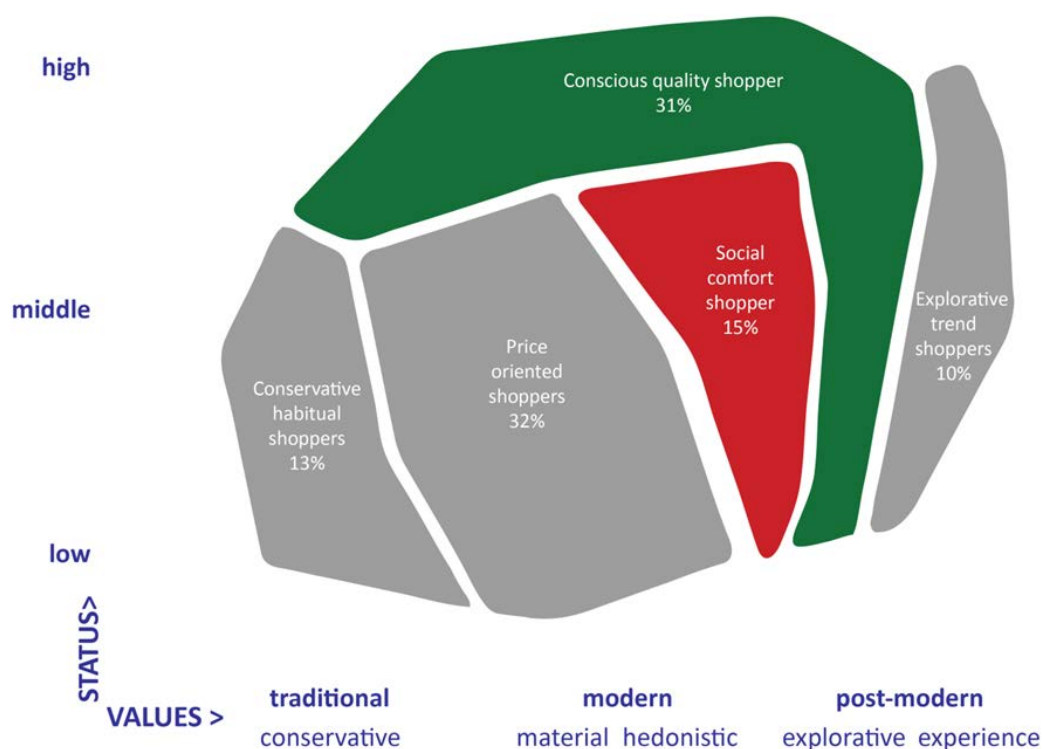


Figure 6 Motivations Mentality segments of the general population, with indication for the two main consumer profiles interested in plant protein consumption. Adapted and translated from Sheet 72 from the green protein event presentation. (9)



4.1.1 The conscious quality shopper

The conscious quality shoppers considers themselves to be critical global citizens who holds values like exploration, self-growth and fulfilment, combining these with modern values like success and status. (10) They are internationally orientated, socially involved and tolerant. The conscious quality shoppers are often engaged with societal challenges and have the drive to do “the right thing.” Their consumption pattern is relatively sober, based on their choice of principles rather than impulses. They are reflective and critical which can make them risk averse. This group consists more often of females than male consumer panel members, mostly within the higher income group. Northern and Western EU countries will have a larger population of this group. Specific questions that conscious quality shopper scored higher on than average in the motivation study were: (9) (10) When asked “how likely will you follow the following advice: Eat less meat and more plant-based food. Vary your intake using fish, pulses, nuts, eggs and vegetarian products.” 48% said to already follow this advice, in comparison to 38% on average,

- When asked if they recognised themselves in the following statement: “I prefer plant based products of animal based products” 52% said to recognise themselves vs. 39% in average.

4.1.2 Social comfort shopper

The social comfort shopper is often younger, career focused, and technology and social media minded people. They are not bound by tradition, are open for a change and like taking risks. They are driven by the ambition to grow in their social status within different aspects of their lives, like sports achievements, career and food choices, and they usually work hard to achieve these. The Social comfort shoppers are most sensitive to the opinion of their peers and are more likely to buy products that are popular with their peers. People in the group are more often male than female, and are present in all income levels and educational levels. EU countries that are experiencing economic growth will see a rise of this group (9) (10). Specific questions that the social comfort shopper scored higher than average on were:

- What does “healthy eating” mean to you?”, 18% of the social comfortshoppers picked the option “eating healthy snacks with extra protein”, compared to the 9% of total average. and 9% answered ‘eating foods that contain extra nutrients like protein, fat burners and slow carbohydrates’, instead of the total average of 4%.
- When asked about which statement they identified themselves the best, the social comfort shoppers scored highest on statements:
 - “I feel good about myself if I have trained at least 3x this week” (26% vs. 14% on average) and
 - “I have changed something about my daily lifestyle in order to live healthier” (29% vs. 12% on average) (9) (10)



4.2 The focus group discussion results

The focus group discussions were held at a neutral location in a roundtable setting. The participants were explained that the researchers present were neutral and not representing a specific company or goal. That there were no “wrong” answer and every opinion was valuable. The participants were presented with four questions, which were established with the WP3 and WP4.1 (see: below). The participants were free to deviate from the questions and respond to other participants during the discussion. The questions were only purposed as a conversation starter. The researchers leading the group discussions did not correct the participants or supplied information, unless they were specifically asked to do so and it would benefit the discussion. The four questions that were presented at the focus group discussion:

1. Which of the products in the box surprised you the most in a positive way, and which one in a negative way?
2. What attracts you in the plant protein products?
3. What is your view on logo’s like the organic Skal logo, or the “better live” label on meat?
4. Which product would you like to see developed?

4.3 Summarised conclusions of the focus group discussion

4.3.1 The fake meat dilemma

During the discussion, it became clear that the “vegetarian chicken” was very appreciated in taste, yet a distinct part on of the group strongly disliked the idea of having to eat fake meat (especially as it was more expensive than real meat). The reasoning was the following. “I don’t need meat to be happy and see no need for having soybeans processed into a fake chicken.” When the meat component did not try to simulate a meat product, like the Quinoa burgers, it did not suffer from this “fake meat” aversion.

4.3.2 “We don’t care about increasing protein, we care about avoiding sugar”

The sentiment for the meat reducers was the following: I eat healthy, conscious and balanced; therefore, I assume to have enough protein in my diet and don’t therefore actively think about protein. The exception to this was people who were strongly into sports and the 3 vegetarians who actively monitored their protein consumption. However, the meat reducers did mention that when checking an ingredient list, they actively tried to avoid excess sugar.

4.3.3 Clean label is important

Having a “Clean label” was highly appreciated. The definition of a clean label is a short ingredient list with recognisable ingredients and no E-numbers or chemical names. When a product naturally contains sugar, it should be explained in the ingredient list. One interesting and notable exception was the category “very similar to meat” products. The participant said: “I already know it is a highly processed product that cannot be natural in any way”.



4.3.4 Soy is a necessary evil and more local options would be welcome

All the participants said to regularly consume soy-based products, and also having mixed feelings about the impact of soy on the environment and their health. The destruction of rainforests was often named, as well as the desire to look for alternatives and more local options. The local alternative should be able to realistically grow in the local climate, without adding any greenhouse gases in the air.

4.3.5 Consumer panel members trust in the Skal Organic logo alone

When discussing the logo question it became apparent that, in general, trust to the food industry is quite low. Almost all logos', except the Skal Organic logo (figure 6), were distrusted. The participants claimed that the other logos' only wanted to sell you more products. They also stated that they struggle to make sense of all the information as a lot of it contradicts itself. When asked what type of logo's they would trust the panel members stated that the logos' should be regulated by an well-esteemed NGO, with a clear guideline, and be free of any scandals. Interestingly enough the "animal-friendly 1, 2 or 3 star (which indicates animal wellbeing in meat) was simultaneously distrusted; "I bet those stars don't really make a difference.". As rigorously followed; I never buy any meat with less than 3 stars (the highest rating). What could be a supporting factor is that the 3-star meat is often also Skal certified organic.



Figure 7 Different versions of the official SKal logo

4.3.6 The food information is so diverse, I don't know how to truly do the right thing

In The discussions the participants indicated that they considered themselves knowledgeable about food, yet, struggled to make sense of the many mixed messages of the products. There was not a single big institution whose opinion they all valued above all others. An example was their motivation to reduce their meat consumption. Almost all agreed that meat has a negative impact on the environment. Yet, when asked to elaborate on how it has a negative impact, their stories greatly varied and contradicted each other. The lesson here is to not trust too much on the in-depth knowledge of the consumer panel members.

4.3.7 Different coping mechanisms for getting a grip on the food information

Here a clear distinction became apparent between the conscious quality shoppers and the social comfort shopper. As previously stated all the consumer panel members were both interested in food information, as well as daunted and confused by the mixed messages. Both consumer profiles showed several coping mechanisms in order to make sense of the food information and "do the right thing."



4.3.8 Conscious quality shoppers trust organic stores and look at the ingredient lists

Conscious quality shopper wants to do the right thing and is willing to invest time and money to do so. Shopping at the organic stores gives them a sense of control and justifies the price increase, compared to the normal supermarkets. One panel member summarised it as the following: The organic shops take care who they do business with because they are very focused on keeping their good reputation. Another coping mechanism is actively reading the ingredient lists of the product. They actively check if a product does not contain a certain substance that they want to avoid like E-numbers, excess sugar, chemical names and trans fats.

4.3.9 Social comfort shoppers trust the front of the package

Social comfort shoppers want to feel like and be perceived by others that they are doing the right thing within their consumption pattern. They are willing to invest money in it, but not as much time and energy as the conscious quality shopper, as they are more convenience orientated. They shop at regular supermarket chains and rather focus on popular brands with a “good story”.

4.3.10 Take care with claims

Here there is another interesting split between the two consumer profiles. The claim “No sugar added” resulted in very different responses. The social comfort shopper responds positively while the conscious quality shopper responds negatively. The quality shopper feels that the product has been “messed with” and that all sort of artificial ingredients were added to uphold the claim. When for example sugar is replaced by concentrated apple juice they consider that the product is trying to “trick them”. A way to please both groups could be: “This product is made with lupine beans which are a natural source of plant protein and fibre.” By focussing on the positive natural properties of the ingredients rather than claiming removing or adding something one does not lose quality shoppers while still pleasing the comfort shoppers.

4.3.11 New food technologies are welcome if they are healthy and exceptionally sustainable.

A panel member brought up Quorn (a fungus based meat substitute which is not similar to meat) (11). Her claim was that Quorn had the lowest environmental impact of all meat substitutes. This spiked great interest in the rest of the panel. When the researcher present mentioned it was grown in a lab in large fermentation tanks, the panel members were briefly shocked but quickly rationalized it as the following: “if it is tasty, healthy and super eco-friendly I am okay with a new technology.”

4.3.12 The following product they would like to see developed

- Healthy savoury, easy to transport snacks like the fava bean snack but with less sugar and salt added to it. In order to combat the temptation when being outside
- A healthy quick savoury breakfast or lunch option
- A replacement for eggs. Being diverse in use and healthy and free of animal products.



5 Conclusion and next steps

The meat reducer – early innovator group shows an increased fondness of pulses and meat substitutes as an alternative on their meatless days compared to the literature. (3) (10) (quinoa, amaranth and buckwheat were not specified in the literature). This makes them a suitable target group for product development for Protein2Food. Within this group the motivation to buy a product has the following hierarchy: most important is taste, then price, followed by a moral or ethical concern, for example: environmental impact. This is unlike vegans and vegetarians who place ethical concern higher.

5.1 Meat replacers

The 3 subcategories that were tested were: “Very similar to meat, (high-quality imitation)”, Not similar to meat (vegetable burger)” and “Traditional meat replacements like tofu.” Their main reasons for avoiding meat (environmental concern (78%) and animal well-being (40%) is also what they want to see reflected in their alternative choices (eco-friendly, local, feel-good story). They still eat meat occasionally and enjoy having the flexibility. When eating meat they opt for the most animal-friendly and organic option. Because meat replacers replace a natural source of protein, the consumer panel members are slightly more sensitive to the “contains plant protein” argument. Unlike vegetarians and vegans, Meat reducers have not cut meat out of their lives, therefore, the meat substitute should have an advantage over their meat choice and other protein options as well as being equally tasty. The high-quality imitation suffers from two biases. Firstly, people don’t like paying more for an imitation of a product than the average price of that original product. Secondly, a distinct part on of the group strongly dislikes the idea of having to eat fake meat. The panel members said it felt like tricking themselves to eat something they do not need. Yet another interesting aspect of the high-quality imitation was that it was okay for it to be very processed as it was already unnatural. The big plus for high-quality imitations was that in a social setting it was easy to serve and bring along as it felt familiar. The “not similar to meat” option seems to have more growth options within this group as it scored highest in Table VI in the tastiest category while staying familiar to prepare and place in a dish. This also coincides with figure 3 “the desired similarity to meat for sensory attributes of new meat substitutes” of the background literature. This indicates that the more frequently consumer panel members eat meat replacement, the less they need them to be similar to meat. They are also considered to be more sustainable than “high-quality imitations.” Traditional meat replacements (Lupine Tempeh) were considered to be healthy, sustainable and tasty in the association's test (Table VII), yet they came on 9th place on taste, out of the 11 tested products with a 4,5 out of 7 for taste in Table VI. They seem to lack appeal and a sense of indulge.



5.2 Snacks

The snack market is constantly evolving. People are looking for healthy, sustainable snacks with a feel good story. The subcategories that were tested were: a Savoury baked fava beans snack and sweet snacks like biscuits (only in the questionnaires). Sweet snacks like biscuits often contain sugar- a substance the focus group discussion indicated they wanted to avoid. they were also considered to be a lot less sustainable than savoury snacks (Table IX 54% vs. 18%). The savoury option was viewed more positively in the light of protein associations and it was indicated by the group that they would like to see more of those developed with the following characteristics: Low on sugar and salt, filling, easy to take on the road.

5.3 Staple foods

The tested staple foods (bread, pasta, milk and breakfast cereal) are part of the common diet in most European countries. It is already common that they come in a great number of varieties, and a protein enriched version is simply another addition to that, making acceptance easy. Because increasing protein consumption itself is not a goal of the meat reducers, the selling point should be sought elsewhere like: health benefits, environmental benefits, increased satiation or improved flavour. The negative associations to be avoided are: “being more expensive than the original” and “Being overly processed and therefore less sustainable.” Claims such as “no sugar added” should also be treated with care because this can indicate the feeling that the original recipe has been messed with and unnatural substances were added.

5.4 New sources of plant protein: lupine bean

Most European consumers are not familiar with the sweet lupine bean that can be consumed in a similar fashion to white beans or chickpeas. In order to test their reactions to different forms of Lupin beans the subcategories: Lupine beans in glass, Lupi Love curry spread and the subcategory dried chopped Lupin beans with a similar function to rice or oats were tested. The Lupin bean’s firm bite was considered novel and yielded mixed reactions from the consumer panel members. Because it was a new product they also struggled to pair it with other flavours. The Lupine spread was positively received and scored second tastiest in Table VI. The recommendation for lupine is to deliver it processed and spiced into a recognisable product in order to overcome the barrier of unfamiliarity.

5.5 Policy recommendations

5.5.1 More plant protein options in public cafeterias

The Meat reducers in general, have a low food identity and enjoy the flexible nature of their consumption pattern. They would however like to have more options that correlate with their food choice preferences: Environmental concerns, animal wellbeing, low sugar and organic. Although these options are well represented in the supermarkets of most urban areas in the Netherlands, they would like to have more healthy (low sugar), meatless, sustainable organic options when eating out. These meals should be tasty, in line with their food preferences, equally filling as their meat counterparts, while preferably being lower in price. A policy recommendation could be to have public institutions like hospitals, school, universities and governmental building to have at least have 20%



plant-protein meal, that are high in vegetables and preferably cheaper than their meat counterpart. This is in-line with the goal of the EU to increase vegetable intake and reduce meat consumption.



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7 Appendix

7.1 Appendix I First questionnaire: recruitment criteria test

Potential participants are asked to fill in the questionnaire. Next, to a standard demographic profile, this contained:

- The validated Neo Food Phobia Questionnaire
- The question “How many days a week do you eat meat at dinner” in order to match the model
- The question “If you eat a meal without meat, with what do you replace it?” in order to match the models of Dagevos *et al.* and Motivaction
- On a scale of 1-7 in these 10 product categories do you do you see de most future potential for like lupine, chickpeas and fava beans

De categories were:

1. Very similar to meat, (high-quality imitation)
 2. Not similar to meat (3e generation vegetable burger)
 3. Traditional meat replacement like tofu and tempeh
 4. Beans as snacks
 5. Beans “made easy” cooked with sauce
 6. Salad bits and grits
 7. Beans replacing cereal
 8. In dried, in can or glass
- On a scale of 1-7 in these 10 product categories do you do you see de most future potential for quinoa, amaranth and buckwheat. (categories were the same as the pulses)

Based on the above-mentioned inclusion criteria 30 of the 31 people were included. Their addresses were collected and a one-day delivery service was used to deliver the products.



7.2 Appendix II Second questionnaire: Product tests in home setting

In order to gain insight into consumers perceptions and behaviour in relation to novel plant protein products. 11 products were selected, put in boxes and delivered with a one-day delivery service. The participant will receive an instruction booklet with recipes and a neutral description of each product. They are to test all the products in a 3 week period and fill in a questionnaire per individual product. In total there is 11 product categories, of which 10 are (novel) plant protein concepts and 1 (beans in glass) will be used as a control group. The categories are:

1. **Very similar to meat, (high-quality imitation)**
Product to be tested in this category is the “Kipstuckjes” tested in WP3.1
2. **Not similar to meat (3e generation vegetable burger)**
Product to be tested in this category is the Quinoa burger from WP3 SME NatureCrops
3. **Traditional meat replacement like tofu and tempeh**
Product to be tested in this category is “Lupine based Tempeh” from Bumi Organics
4. **Beans as snacks**
Product to be tested in this category is the “Fava bean snacks” form the Albert Heijn
5. **Beans “made easy” cooked with sauce**
Product to be tested in this category is the “Chickpea curry” from Boon
6. **Salad bits and grits**
Product to be tested in this category is “lupine in glass” as salad garnish from WP3 SME mfh Pulses
7. **Beans replacing couscous**
Products in this category will be “Quinotto” risotto based on quinoa from WP3 SME NatureCrops
8. **Protein enriched pasta**
The protein enriched pasta from Tasty basics
9. **New base material**
lupine bites which are chopped dried lupine beans that can be used as rice, cereal or coarse flour replacement
10. **Protein enriched bread**
The protein enriched and fibre bread from Tasty basics
11. **Pulse-based spread**
lupilove curry

In a period of 3 weeks, they will try these products and fill in a questionnaire when consuming the product. The question was kept as short as possible to stimulate adherence. The questions of the food diary are:



Open questions:

1. How did to prepare the product?
2. What did like or dislike about the product?

Closed questions

On a scale of 1 to 5, with 5 being “very much” please indicate how much you agree with the following statements:

1. The product was delicious
2. The product was easy to prepare
3. I was familiar with the product
4. I would recommend this product to a friend or family member
5. Open question: What is the minimum amount you would for this product and what is de maximum amount?
 - What do you expect when you read the phrase < individual product > ”with extra plant protein”> (Tick the boxes you think are most relevant, max 5 boxes)
 - It contains soy/soy is added
 - It is a “light” product
 - It will help to support muscle growth
 - It will contribute to a healthy digestion
 - It has a negative impact on the in
 - It will be extra filling
 - It will be more expensive
 - It will be extra nutritious (more amino acids, minerals and vitamins)
 - It will be more sustainable
 - it will taste less good
 - It is very processed
 - Something else (open question)
6. Do you have any remarks about the product you would like to add? (open question)

Some individual product questionnaires will contain 1 or 2 unique extra questions, in order to add all the WP3 input. The extra questions are either a repeat question 6 with a product that was not in the box (plant milk, breakfast cereal and sweet snacks) or the open question: “In order to participate in this study, you have indicated that you do not eat meat for at least one day a week. What is your motivation for doing this?”



7.3 Appendix III Focus group discussion

After the 3 week period, the focus group discussion panel will be held. Were 3 questions will be asked concerning the product experience.

1. Did you change your eating habits in the past 12 months? What was the reason for this
2. What type properties do plant protein products need to have? If this is indicated with a label, do you trust this label and are you willing to pay more for it?
3. Which product surprised you the most and why? in what type of dish?
(aimed towards product development)

8 Delays and difficulties

The project member Dr. Lucy van de Vijver resigned from the Louis Bolk Institute at the beginning of 2016. Due to the successful involvement of her replacer Dr. Peter J. Voshol the responsibilities and tasks of LBI in WP4 could continue unchanged. Olga Patijn was engaged in the project in the beginning of 2017. The transitions have cause delay in communication and research development towards consumer preferences and consumer market inventory. Furthermore, we struggled to recruit enough participants for the consumer studies. To overcome this issue, we added a financial award of 70 euro's for participation. The financial rewards were paid from the LBI's own budget and not the PROTEIN2FOOD budget. The results of the studies were presented and discussed at the PROTEIN2FOOD 2nd annual meeting in Caserta, Italy on 30 May – 1 June 2017. Deliverable 4.2 was composed after the annual meeting, to include the feedback from the entire consortium. During the autumn the deliverable went through the internal PROTEIN2FOOD review process, hence, the further delay. This delay have not influenced the overall progress of the project nor delayed any other work packages or tasks.

9 Impact and dissemination activities

A two page Dutch article was published in the Ekoland magazine which aims at organic farmers and policy makers.

A English one page article was published in the newsletter of EUFIC - European Food Information Council.

It will be presented to the Dutch Green Protein Alliance.

